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REVIEW OF STUCK SLIDES

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A. E. Byrdson 10-10-90

B. Cleary 10-18-90

PM Eck 10-18-90

By: W. K. Alexander
W. K. Woods

Date: March 15, 1948

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TECHNICAL DEPARTMENT

REVIEW OF STUCK SLIDS

Records show that difficulty has been encountered with the discharge of two tubes in B Pile, twelve in the D Pile, and fifteen in the F Pile during the period from initial start-up until March 15, 1948. In sixteen cases the tubes have been replaced, six of the tubes which were in the fringes have been made air tubes, four did not warrant replacement, and three are to be replaced in the future.

General statistics for these twenty-nine tubes are given in Table I and additional details are given in Table II.

W. K. Alexander
W. K. Alexander

W. K. Woods
W. K. Woods

WKA:WEN:er

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TABLE I

REVIEW OF STUCK SLUGS

<u>Case No.</u>	<u>Discharge Date</u>	<u>Tube No.</u>	<u>M.D.*</u>	<u>Days</u>	<u>Cycle</u>
1	7/27/45	2174-F	24.5	152	1
2	10/31/45	1768-B	51.8	284	2
3	12/13/45	2194-D	28.5	362	1
4	12/24/45	3671-B	45.3	290	2
5	4/18/46	1889-F	25.5	208	2
6	5/7/46	2692-D	26.4	212	2
7	9/17/46	2382-D	62.6	383	2
8	10/23/46	2284-F	26.8	216	3
9	4/6/47	3396-D	28.0	841	1
10	4/6/47	1252-F	28.2	770	1
11	6/3/47	3188-D	25.2	189	1
12	6/25/47	4392-F	28.6	850	1
13	9/9/47	3867-D	25.1	184	3
14	10/8/47	0182-F	28.2	955	1
15	11/3/47	4376-D	26.3	232	4
16	11/4/47	1376-F	19.0	153	5
17	11/11/47	4194-F	27.2	989	1
18	11/11/47	4559-F	27.2	989	1
19	11/11/47	4588-F	27.2	989	1
20	11/17/47	1451-F	27.4	995	1
21	2/6/48	2464-D	25.1	161	1
22	2/16/48	3183-D	24.0	160	1
23	2/16/48	3672-D	25.8	174	1
24	2/16/48	3684-D	25.1	195	1
25	2/17/48	1875-F	25.4	174	6
26	2/17/48	2078-F	25.6	174	6
27	2/24/48	1481-F	25.4	181	5
28	2/24/48	3282-F	25.5	181	8
29	3/2/48	3189-D	25.4	224	5

* An exposure of 25 Megaratt Days per tube corresponds to a nominal average exposure of 200 MD/ton of metal in a tube containing 32 eight-inch slugs.

TABLE II**DETAILS OF STUCK SLUG INCIDENTS****Case 1 - Tube No. 2174-F**

Boreoscopic examination on September 14, 1945, revealed a gouge at top of tube which was continuous for downstream 2/3 of tube. This limits the offending slug to a position somewhere about the 3rd or 4th from the upstream end. The tube was replaced on November 5, 1946.

Case 2 - Tube No. 1768-B

It is stated in the weekly report of the Water, Corrosion, and Engineering Group that this tube pushed hard on October 31, 1945. Examination of the metal from this tube showed several pieces to be either blistered or swollen. No other information is available. This tube was not replaced.

Case 3 - Tube No. 2194-D

One slug discharged from this tube was blistered and warped. It was severely scratched at both ends on one side and at the middle of the opposite side. Inspection of this piece indicated that it was warped over its entire length. This tube was replaced on December 13, 1945.

Case 4 - Tube No. 3671-B

This tube was discharged during the extended shutdown which started on December 11, 1945. Boreoscopic examination on February 5, 1946, revealed severe gouging on top of the tube and on the ribs, starting at a position corresponding to the 14th slug from the upstream end. One of the slugs from the tube was badly blistered with large bumps. This tube was replaced on April 17, 1946.

Case 5 - Tube No. 1889-F

Boreoscopic examination showed that the tube ribs had been damaged during discharge, but damage did not warrant tube replacement. One slug from this tube was badly blistered.

Case 6 - Tube No. 2692-D

Boreoscopic examination on June 4, 1946, showed scratches starting at points separated by eight inches, corresponding to both ends of the 12th or 13th slug from the upstream end. One slug from the discharge was badly blistered and bowed, with scratches at center of one side and at both ends of the opposite side. This tube was replaced on June 19, 1946.

Case 7 - Tube No. 2382-D

This is a doubtful case in that no mention of difficulty appears in the P Department record. However, the Final Report on Production Test 105-76-F, November 29, 1946, Document 7-5422, states that this tube "contained . . . one badly warped piece which was pushed through the tube with difficulty." This warped slug was located in the 12th, 13th, 21st, or 25th position from the upstream end. This tube was not replaced.

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Case 8 - Tube No. 2284-F

Boreoscopic examination showed scratches starting at a distance 14' - 4" from the inlet end of the front nozzle, corresponding to the downstream end of the 5th slug or upstream end of the 6th slug from inlet end of tube. One slug from the discharge had swollen areas, small blisters, and some warp. This tube was replaced on November 5, 1946.

Case 9 - Tube No. 3396-D

The stuck piece from this tube had large swollen areas which caused it to bend in the center. Boreoscopic examination of the tube revealed that the offending piece had been in the 22nd position from the upstream end. There were two other pieces in this tube which were bowed, one of which could possibly have caused some binding. The tube was replaced on April 15, 1947.

Case 10 - Tube No. 1252-F

This tube contained one piece which was moderately blistered on the surface but was warped over its entire length. This piece was severely scratched and galled during discharge. Boreoscopic examination of the tube indicated that this piece had been located in the 19th position from the upstream end of the thirty-five slug column. This tube was replaced on May 7, 1947.

Case 11 - Tube No. 3182-D

During the discharge of this tube sticking occurred after twelve metal pieces had been pushed. Boreoscopic examination of the tube showed it to be galled at the inner end of the gun barrel. Inspection of the metal revealed no pieces which were blistered enough to stick but several were scratched more than usual. The tube was replaced on June 17, 1947.

Case 12 - Tube 4392-F

This tube was found to be stuck on June 25, 1947, and inspection of the pieces from this tube disclosed that the sticking had been caused by one warped piece which was only slightly blistered on the surface. Boreoscopic examination of the tube showed this piece to have been stuck in the 17th position from the upstream end of the 35-piece column. This tube position is no longer being used.

Case 13 - Tube 3867-D

This tube could not be broken loose by using the automatic charger nor by six men using a push pole. One man was able to break it loose, however, with the Wilmington charger. The offending piece could not be located among the nineteen pieces which were isolated from this tube. The tube was replaced on September 16, 1947.

Case 14 - Tube 0182-F

The charge from this tube was broken loose by two men using the hand charger. Boreoscopic examination showed the stuck piece to have been in the 23rd position from the upstream end of the thirty-five piece column. The offending slug was found to be only slightly blistered on the surface but was warped over its entire length. This tube position has been abandoned.

Case 15 - Tube 4376-D

Examination of the metal from this tube revealed one piece which was extensively blistered with large swollen areas which gave the slug such an over-all distortion as to cause it to be stuck in the tube. The position of this piece in the tube was not determined. This tube was replaced on January 19, 1948.

Case 16 - Tube 1376-F

The charge in this tube was broken loose by back-seating with the hand charger and was then pushed with the automatic charger. The offending piece was in the 13th position from the upstream end of the column. This piece was found to be both extensively blistered and warped. The slugs in this tube consisted of cycled and uncycled type F Virgin metal which was being tested on Production Test 105-102-F. The bad piece was one of the cycled ones. The tube was replaced on December 2, 1947.

Case 17 - Tube 4194-F

The charge in this tube was quite difficult to break loose and pushed hard for some distance. The pieces from this tube were caught together with those of another tube. From this group of seventy slugs there was one which had been definitely stuck due to bowing. Several others were badly scratched but did not appear to have been stuck. The position of the stuck piece was not determined. This tube position is no longer in service.

Case 18 - Tube 4599-F

This charge was not difficult to break loose and moved freely out of the tube after it was broken loose. Only twenty-nine of the thirty-five pieces in the tube were recovered. One of these was quite badly bowed but did not appear to have been stuck. The position of the stuck piece was not determined. This tube is no longer being used.

Case 19 - Tube 4588-F

This tube of metal was dislodged quite easily and pushed freely once it was loose. The metal was mixed with that of Tube 4194-F previously mentioned. The position of the stuck piece was not determined. This tube position is no longer in service.

Case 20 - Tube 1451-F

This tube required a force of over 4000# using the expanding mandrel to break it loose. It pushed hard for the entire distance. The offending piece was found to have been very badly warped. The position of this piece was not definitely determined. This tube position is no longer in service.

Case 21 - Tube 2464-D

The charge in this tube was found to be stuck solid during the regular discharge of February 3, 1948. It could not be moved by four men using the hand charger in either direction. The upstream dummies including all of the lead and perforated aluminum were removed and replaced with solid aluminum dummies. A hydraulic jack was employed and by using a maximum of 7400 pounds force, with the expanding mandrel in place, the charge was moved downstream approximately twelve feet where

it again stuck solid. All pieces downstream of the stuck one were washed out by using 450 pounds/sq. in. water piped directly to the tube inlet. A total of eighteen pieces were thus removed from below the stuck piece. The charge was then backseated about six inches with a maximum force of 3600 pounds being required. After borescopic examination of the stuck slug and tube the ribs were reamed out from the stuck piece to the end of the tube which allowed the piece to be pushed out freely. Examination of the offending piece showed it to be badly distorted by very large swollen areas. These individual distortions caused the piece to become crooked instead of its being smoothly bowed as some pieces have been. This tube has not been replaced as yet.

Case 22 - Tube 3183-D

The charge in this tube could not be moved in either direction by using the hand charger. A long spline was inserted under the stuck piece and it was worked loose in this manner. The offending piece was distorted by large blisters or knobs. There was an especially large one which rubbed on the top of the tube. The exact position of this piece was not determined. This tube was replaced on February 19, 1948.

Case 23 - Tube 3672-D

This charge could not be broken loose by using the hand charger from either direction. The expanding mandrel was inserted and a force of 2500 pounds by the hydraulic ram started the charge moving. After the first few inches the charge moved freely until the bad piece went through the gunbarrel where it hung up momentarily. There were three extensively blistered pieces on this tube, one which had been definitely stuck due to the large distorted areas, one which could possibly have been stuck some, and one which showed no sign of sticking. This tube has not been replaced.

Case 24 - Tube 3684-D

The history of this tube was almost identical with that of 3672-D. It only required 1500 pounds force by the ram to break it loose. The stuck piece from this tube was both extensively blistered and warped. This tube has not been replaced.

Case 25 - Tube 1875-F

This tube was easily broken loose with the hand charger and extra oil. The pieces did not hang up in the gunbarrel but went out smoothly. The metal from this tube was caught in the box with that from 2078-F and from the combined charges two pieces were isolated which had been definitely stuck. One of these pieces was badly warped but only slightly blistered on the surface. The other piece was extensively blistered with very large abrupt knobs or bumps. This tube was replaced on March 4, 1948.

Case 26 - Tube 2078-F

This tube was discharged in the same manner as 1875-F and the description of the blistered slug is also given under that Case. This tube was replaced on March 4, 1948.

Case 27 - Tube 1481-F

In an attempt to loosen the charge in this tube, with a special screw cap from

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the rear, the rear Van Stone flange was broken. The Van Stone was repaired and an attempt with the ram using a maximum of 2000 pounds also failed from both the front and rear. The dummies were removed and replaced with solid aluminum dummies. The charge was then successfully broken loose by using a maximum force of 5000 pounds. The mandrel was installed before this high force was applied. The ram was then used from the front to discharge the tube. The offending piece from this tube was badly distorted with large swollen areas. There were indications that this piece had rubbed the tube on all four sides at different points along its length. This tube was replaced on March 4, 1948.

Case 28 - Tube 3282-F

An unsuccessful attempt was made from both the front and rear to break loose this charge with the hand charger. The ram also failed from both the front and rear when a maximum of 2000 pounds was used. The dummies were then removed, the mandrel inserted, and 3000 pound force loosened the charge. The offending piece was badly distorted with very large blisters or bumps. This tube was replaced on March 4, 1948.

Case 29 - Tube 3189-D

This tube, which was loaded with 4" pieces, was hard to break loose when discharged. Examination of the 4" metal pieces revealed no reason for the sticking. The tube was reloaded with metal.

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